LIBRE
Lignin Based Carbon Fibres for Composites

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CHALMERS
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Recommendations for Routes to Sustainable Exploitation of CFRP Materials

Review of Life Cycle Assessments of Carbon Fibre Reinforced Materials

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Agenda

- Literature review
- Results: Comparing results for climate impact from different studies
- Results: Transitioning from PAN to lignin as precursor for carbon fibres in CFRP
- Results: Energy savings from reusing carbon fibres
- Conclusion and future work

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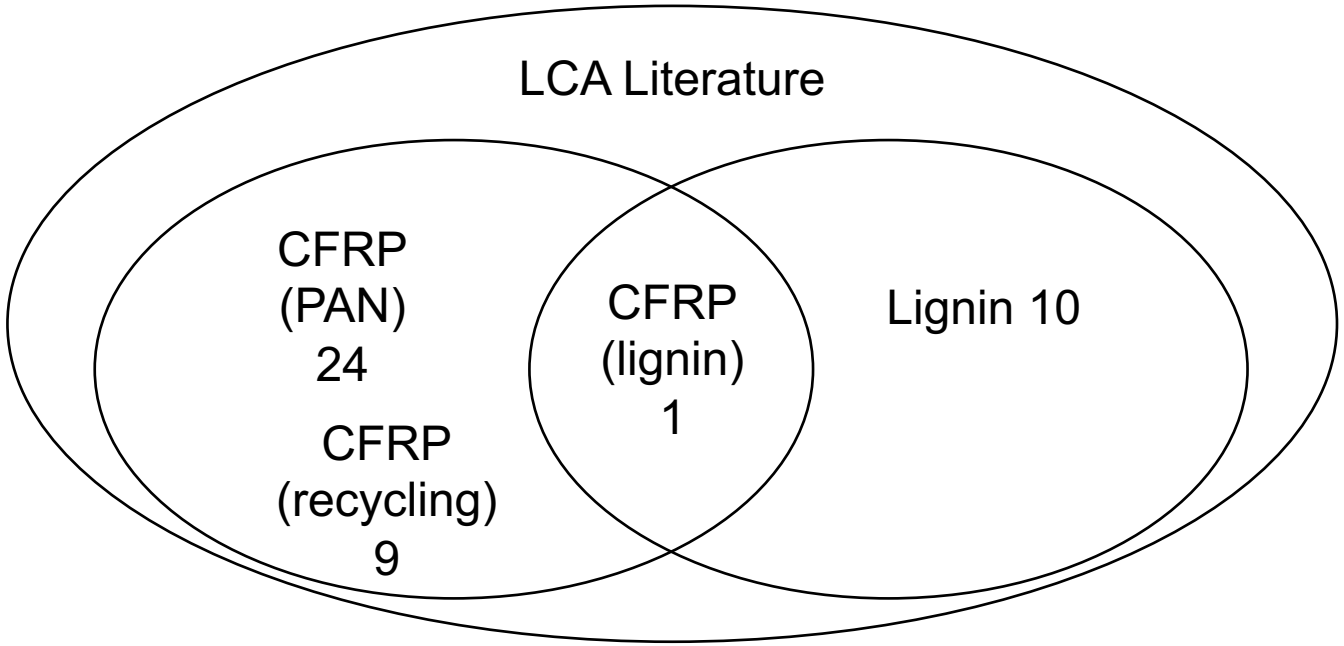
Literature review

- **33 LCAs of CFRP was found**
  - **Only one study (Das, 2011) assessed lignin based carbon fibres**
    - **The literature review was expanded to also include LCA of lignin (10)**



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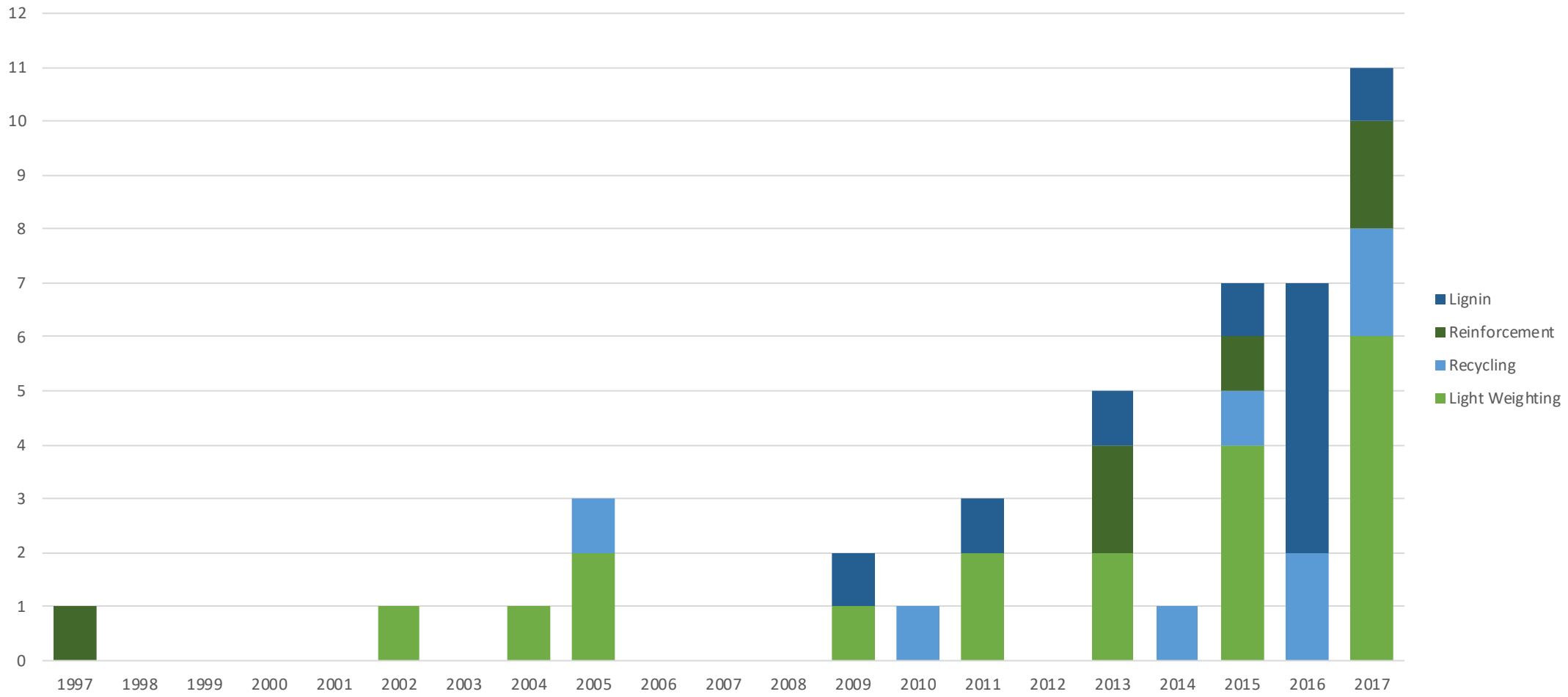
Literature review



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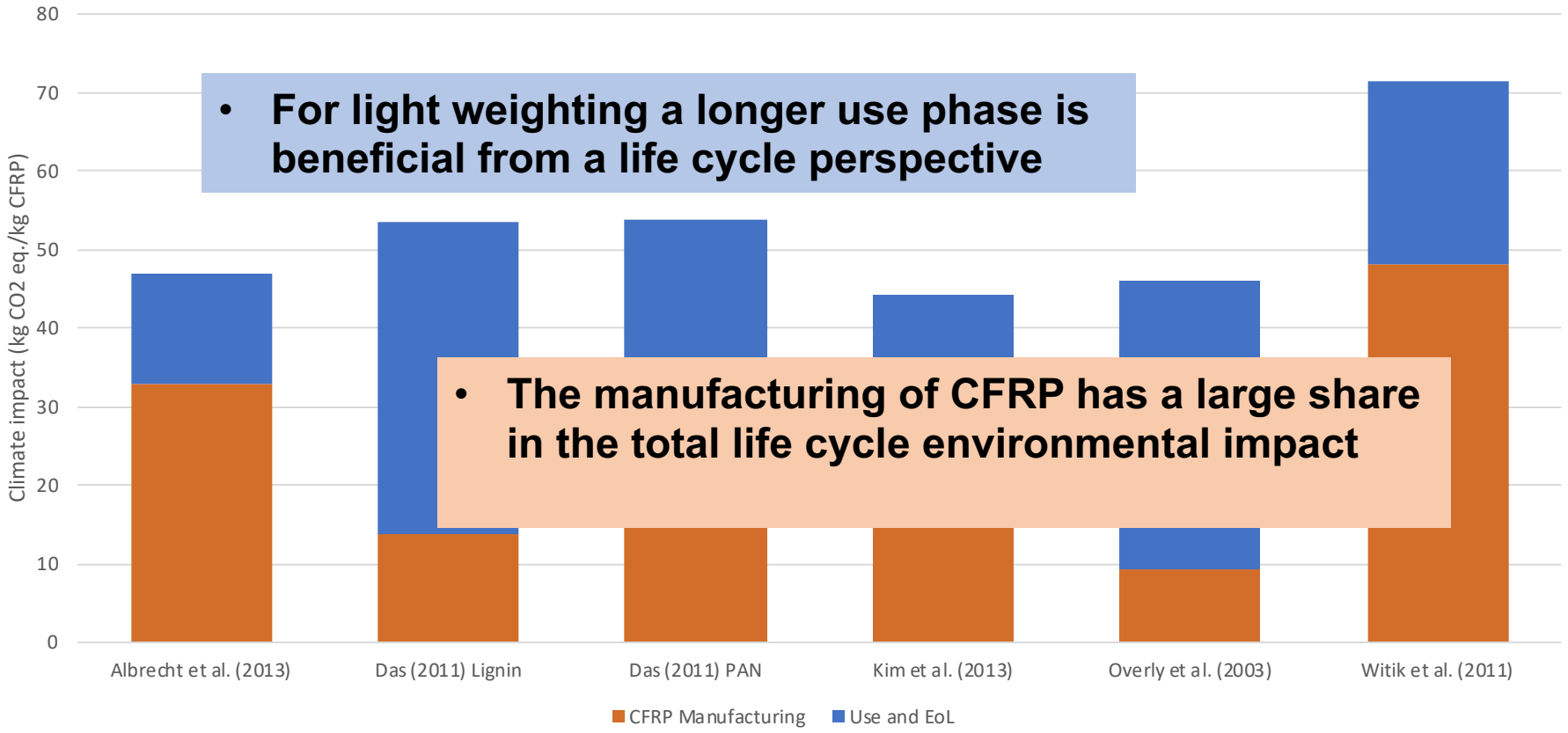
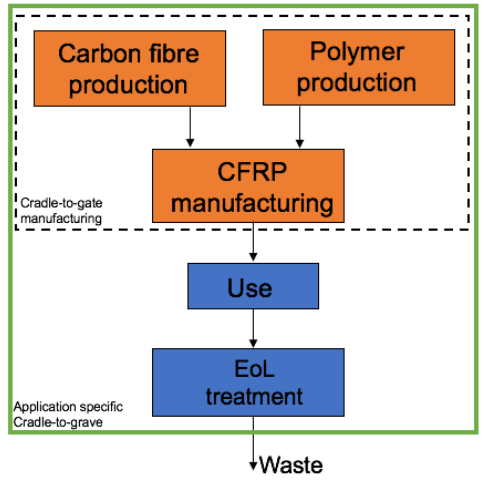
• Results: Light weighting climate impact





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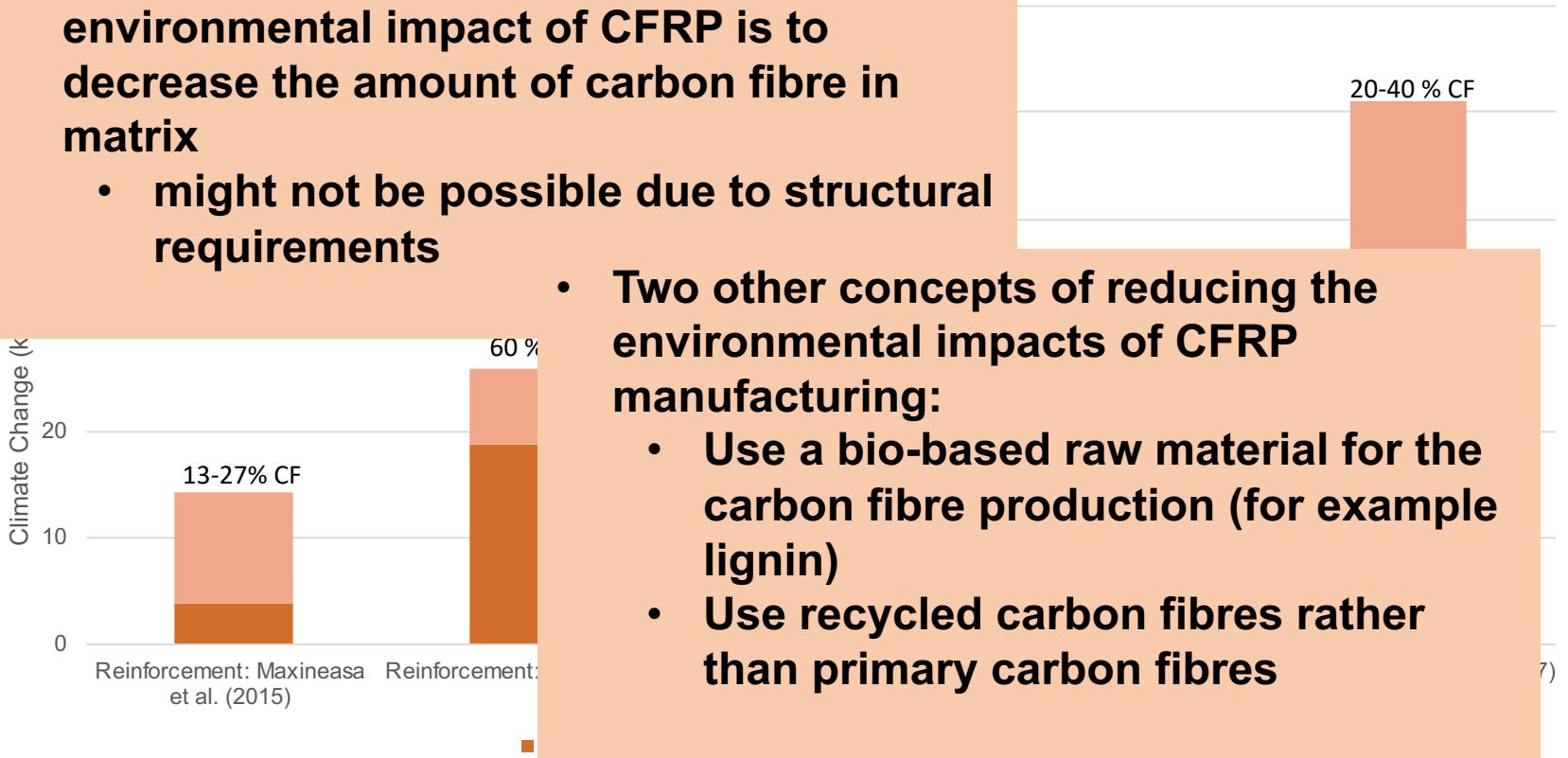
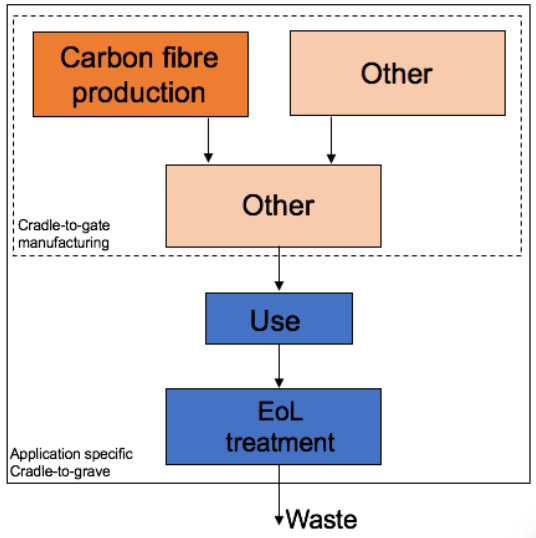
Results: Materials and manufacturing climate impact

- **Most obvious way to decrease the environmental impact of CFRP is to decrease the amount of carbon fibre in matrix**
  - **might not be possible due to structural requirements**



- **Two other concepts of reducing the environmental impacts of CFRP manufacturing:**
  - **Use a bio-based raw material for the carbon fibre production (for example lignin)**
  - **Use recycled carbon fibres rather than primary carbon fibres**



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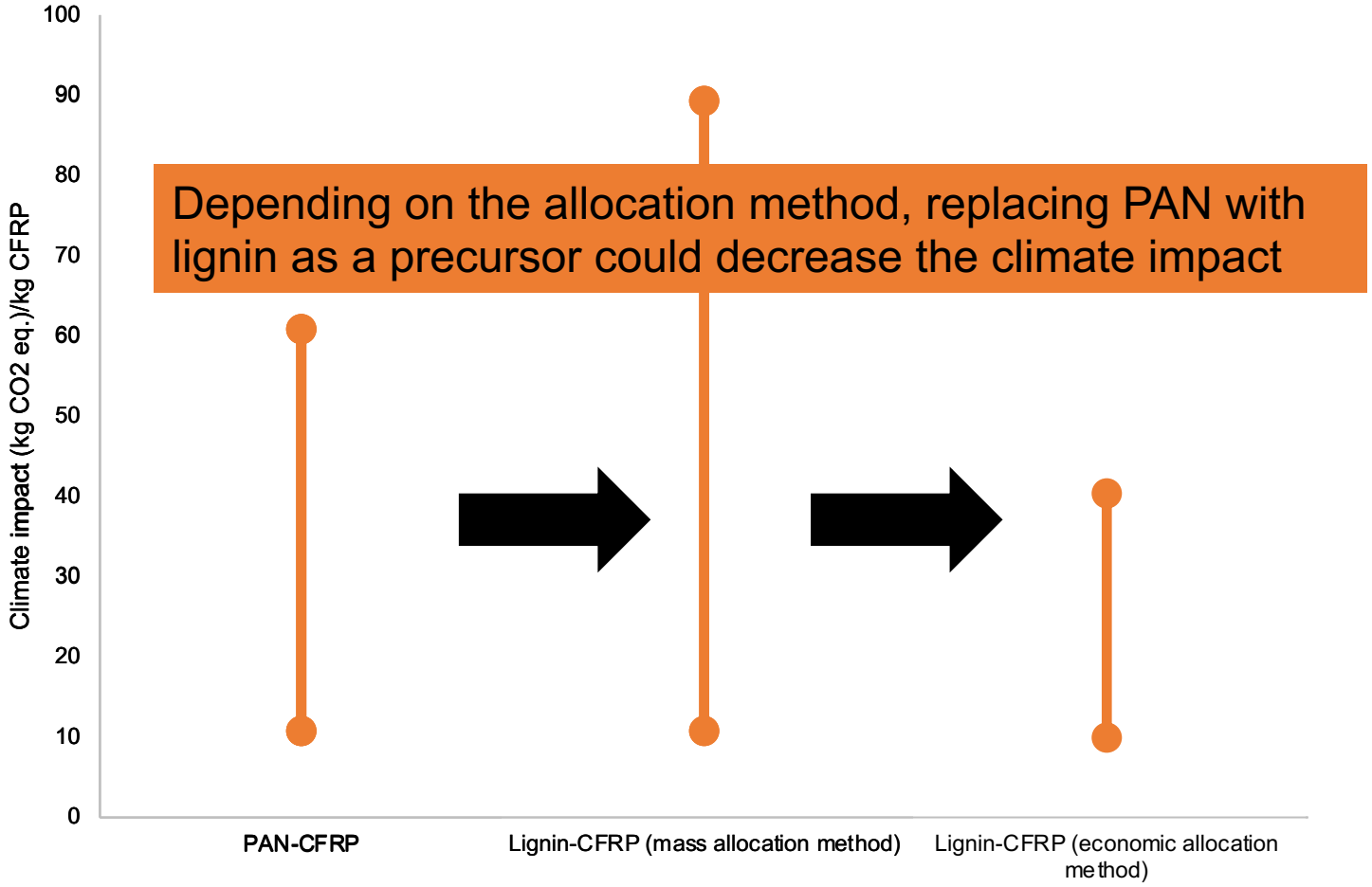
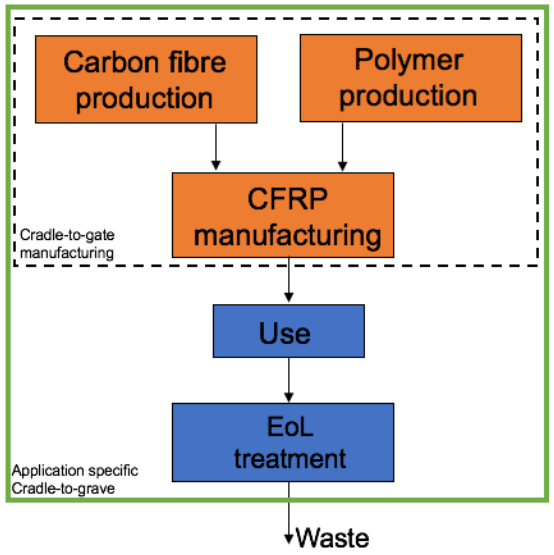
Results: Materials and manufacturing – Replacing PAN with lignin





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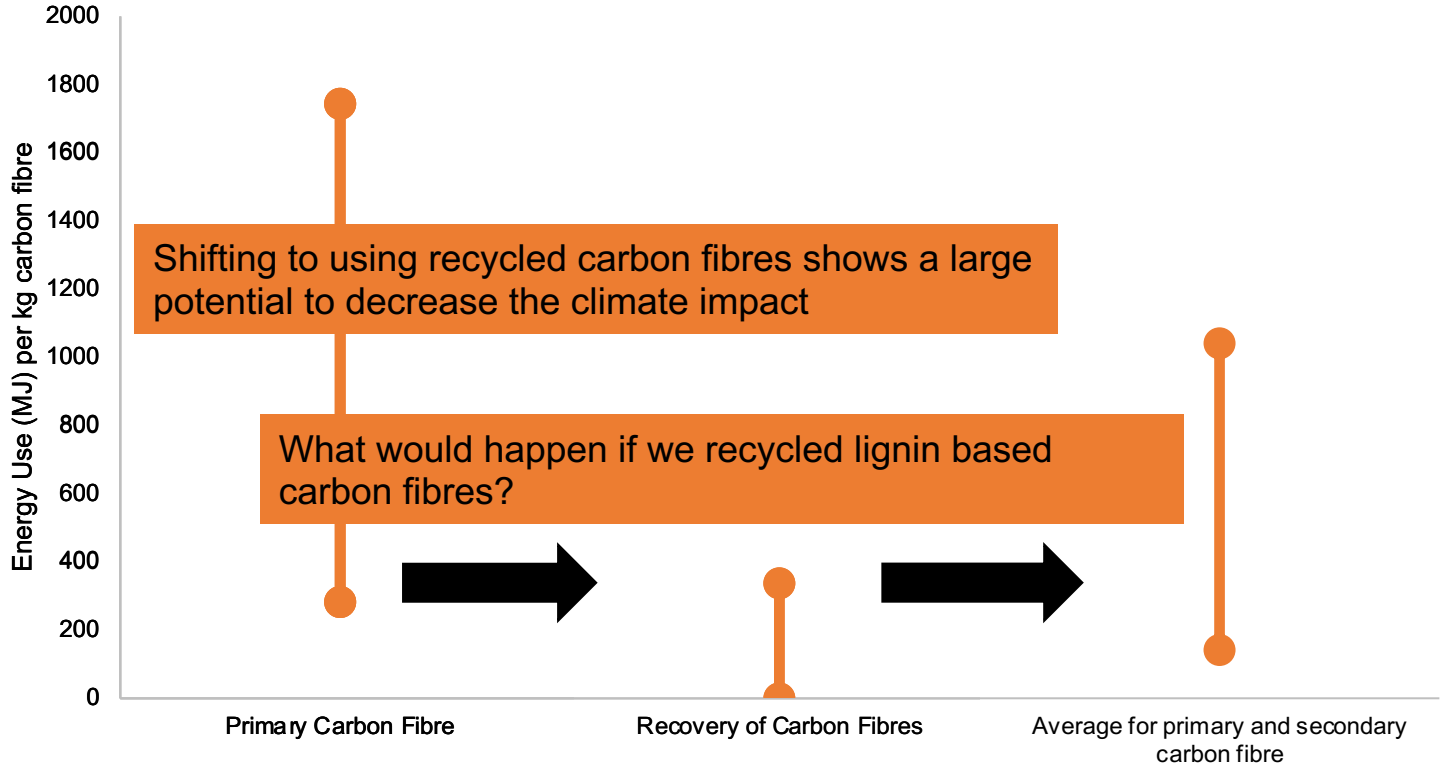
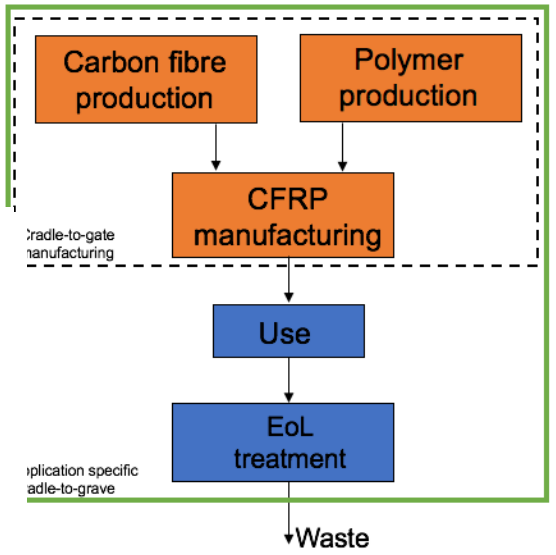
Results: Demonstrated gains from recycling





(Includes only 2 PAN-CFRP studies)

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Conclusions

- **Three main aspects need to be considered to decrease the environmental impact of CFRPs**
  - **Decrease amount of carbon fibre in matrix**
  - **Prolong the life time of the product (mileage in light weighting)**
  - **Decrease the environmental impact of the production for the CF by for example shifting to a bio based precursor**
  - **Look into recycling opportunities to reuse carbon fibres/CFRP**

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Future work

- Life Cycle Assessment of lignin based carbon fibres
  - Comparing different lignin and polymer blends
- Carbon fibre=> CFRP=> in applications
  - Addressing challenges in going assessments in early stages of material development
- By this review we have mined the literature from whatever we can learn for or own LCA. Three methodological challenges are:
  - Allocation of lignin: Waste or a by-product?
  - Allocation when including recycling of CFRP
  - Comparing a fossil-based material to a bio-based material

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Thank you all for your attention!